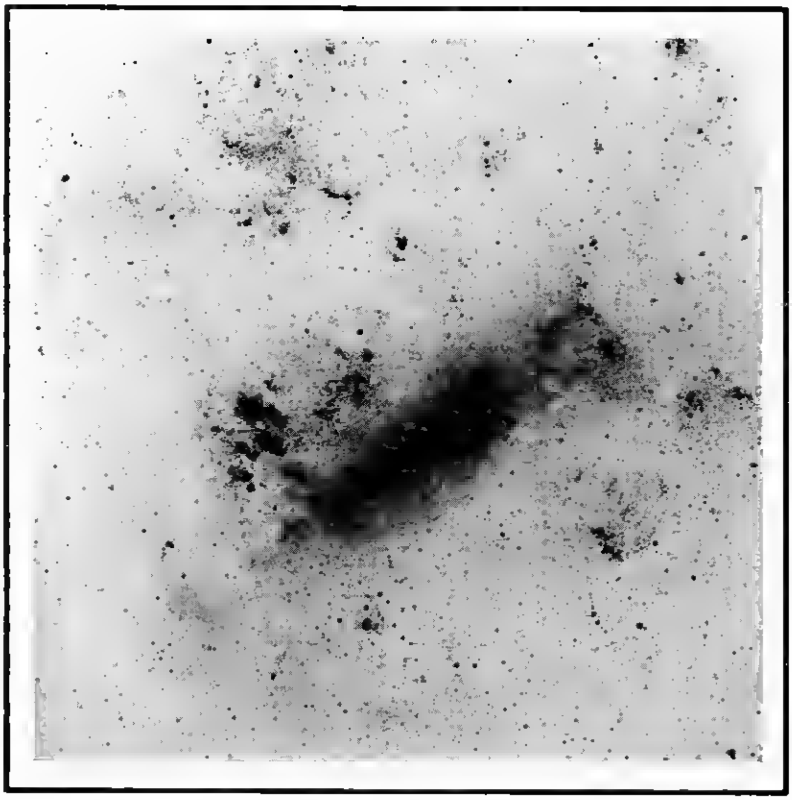
The MOUNT JOHN UNIVERSITY OBSERVATORY PHOTOGRAPHIC SKY SURVEY and the CANTERBURY SKY ATLAS (AUSTRALIS)



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THE

MOUNT JOHN UNIVERSITY OBSERVATORY PHOTOGRAPHIC SKY SURVEY

and the

CANTERBURY SKY ATLAS (AUSTRALIS)

Southern Extensions
of the
Lick Observatory Sixteenth Magnitude Photographic Sky Survey
and the
Lick Observatory Sky Atlas

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MOUNT JOHN UNIVERSITY OBSERVATORY

LAKE TEKAPO
NEW ZEALAND

University of Canterbury (Department of Physics)
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University of Florida (Department of Physics and Astronomy)

Department of Physics, University of Canterbury Christchurch 1972

Cover Illustration. **THE LARGE MAGELLANIC CLOUD**

A reproduction to scale from a part of Plate 4 of the *Mount John University Observatory Photographic Sky Survey*.

UNIVERSITY OF CANTERBURY PRINT

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1 INTRODUCTION

1.1 THE LICK OBSERVATORY SIXTEENTH MAGNITUDE PHOTOGRAPHIC SKY SURVEY The negatives for the *Lick Observatory Sixteenth Magnitude Photographic Sky Survey* were obtained by C.D. Shane and C.A. Wirtanen during 1953, 1954 and 1955, originally for the purposes of a uniform investigation into the spatial distribution of extragalactic nebulae to a limiting magnitude of 15. An investigation of this nature to magnitude 19 in three selected northern areas is reported in Shane & Wirtanen (1967). The Lick survey consists of a record on glass of 166 regions at a scale quoted by Ingrao & Kasperian (1967) to be 232 arc second per millimetre. Each plate is centred on one of the nine declinations of -30°, -15°, 0°, +15° +30°, +45° +60°, +75° and +90°. There are 24 regions in each of the first five of these zones and 20, 15, 10 and 1 respectively in the last four. These regions have been given, by extension of the southern numbering scheme, the plate numbers 47 to 212 in Tables I, II and III and in Figures 1, 2 and 3 on pages 10 to 15. Ingrao & Kasperian (1967) give the limiting magnitude as 16 for the Lick survey.

1.2 THE LICK OBSERVATORY SKY ATLAS. The *Lick Observatory Sky Atlas* (Shane, 1958; Lick Observatory, 1965) has been produced in limited editions from the above survey plates, to essentially the same scale, by the staff of the observatory. It has been used for a wide variety of purposes where it is unnecessary or inconvenient to have the fainter limiting magnitude, larger scale and smaller field of the less readily accessible and more costly *National Geographic Society — Palomar Observatory Sky Survey* or *Atlas* (Minkowski & Abell, 1952).

1.3 THE MOUNT JOHN UNIVERSITY OBSERVATORY PHOTOGRAPHIC SKY SURVEY. Mount John University Observatory was established in 1963 by the Universities of Canterbury and Pennsylvania and opened at Lake Tekapo in 1965. The University of Florida (Gainesville) became a participating university in 1970. Early in 1965, F.B. Wood, Professor of Astronomy at the University of Pennsylvania (now at the University of Florida), announced from the observatory that a suggestion to extend the Lick survey to the south pole would be the basis of a two-year project of plate-taking at Mount John. C.D. Shane, Astronomer Emeritus, Lick Observatory, agreed to initiate the observing to ensure continuity with the Lick survey while the University of Canterbury agreed to undertake the subsequent preparation of an atlas to be reproduced from the plates and to provide permanent storage for the latter. The *Mount John University Observatory Photographic Sky Survey* was started in March, 1966, by C.D. Shane. It extends the zone pattern of the *Lick Observatory Sixteenth Magnitude Photographic Sky Survey* to the south pole but covers all the 142 regions accessible from the observatory, namely those centred on the eight declinations from -90° to +15°. These regions have been numbered 1 to 142 from the south pole northward as shown in Tables I, II and III and in Figures 1, 2 and 3. The southernmost 46 regions in the four zones centred on -90° to -45° give all-sky photographic coverage for the first time to a nominal limiting magnitude of 16, though the limits on individual plates range between about 16 and 17. The plate scale is about 231 arc second per millimetre. The remaining 96 plates of the

142 regions accessible from Lake Tekapo (plates 47 to 142) give repeat coverage of regions in the Lick survey, in some cases at a more favourable zenith angle or under more favourable conditions. It was not possible to obtain satisfactory plates for all the 142 regions during the original two-year period of the programme in 1966 and 1967. Plate-taking was resumed, however, in late 1970 and by November, 1972, it was only necessary to map three regions, all at 7^h right ascension (plates 78, 102 and 126), to complete the survey. These are regions which only appear on the meridian during the comparatively short nights of the southern mid-summer and are consequently rather difficult to obtain, particularly when account is taken of those nights with unfavourable phases of the moon or unsatisfactory observing conditions. Relaxation of the requirement that exposures be centred on the meridian has permitted the acquisition of suitable plates for all of these regions during December, 1972.

Exposure of plate 96 on 19 August, 1966, lead immediately to the independent discovery by A.J. Thomas of Comet 1966c (Barbon) as recorded by Porter (1967).

1.4 THE CANTERBURY SKY ATLAS (AUSTRALIS) The *Canterbury Sky Atlas (Australis)* consists of a limited edition (200 copies in 1972) of negative prints reproduced in Christchurch during 1971 and 1972 from the 46 southernmost regions (plates 1 to 46) not previously surveyed to a limiting magnitude as faint as 16. The star fields, each covering $18^{\circ}\!.0$ by $18^{\circ}\!.0$ at a print scale of about 232 or 233 arc second per millimetre, have been reproduced to match the *Lick Observatory Sky Atlas* as closely as possible. Differences between the star fields on the original plates and those on the prints can be attributed almost entirely to shrinkage of the printing paper (amounting typically to 1 part and at most to 2 parts in about 300) and to the unavoidable minimum loss in image quality to be expected in photographic reproduction in two stages. The opportunity has been taken of incorporating on each sheet a number of items to facilitate their use as a survey atlas. The nominal centre of each region and the orientation of the star field relative to the paper have been defined with fiducial marks placed mid-way along each of the four edges of the star fields to permit rapid and precise application of overlay réseaux.

2 THE COOK TELESCOPE AND ITS 12.5 cm f/7 ROSS ASTROGRAPH

The first telescope belonging to Mount John University Observatory came into operation in 1964. This was an instrument that had been manufactured in 1936 by J.W. Fecker and Company of Pittsburgh and supported three astrographs for the already well-equipped private observatory of the late Gustavus W. Cook at Roslyn House, Philadelphia, the facilities of which were later incorporated into the Flower and Cook Observatory of the University of Pennsylvania. Some of the instruments and work of Cook are described by Ingalls (1932, 1934 and 1935) and in various parts of King (1955). Cook bequeathed his telescope to the University of Pennsylvania but prior to its transfer to New Zealand in 1963 it was on loan to the McDonald Observatory of the University of Texas in Fort Davis where it was used in minor planet studies. The *Cook Telescope* carries three f/7 cameras, all with lens systems manufactured in accordance with the design of Frank E. Ross (Miczaika & Sinton, 1961). This design, involving four lens elements, embodies substantial improvements in definition made possible by about 1930 with more sophisticated systems than those used previously for wide field-of-view astrography. The

world's largest instrument using this wide field-of-view design is the 51 cm *Ross Astrographic Lens* at Lick Observatory (King, 1955, p396). The three cameras on the *Cook Telescope* have apertures of 25, 12.5 and 10cm, the 12.5 cm system apparently being essentially identical to the Ross lens used at Mount Wilson, California, and Flagstaff, Arizona, by Ross and Calvert (1934, 1936) to obtain the negatives for their *Atlas of the Milky Way.* The original Ross lens of the *Ross-Calvert Atlas* was loaned in 1953 by Mount Wilson Observatory, along with their 25 cm telescope mounting, to Lick Observatory for the production of the Lick survey negatives. The same Ross lens was again generously made available by Horace W. Babcock in 1965 for the purposes of the Mount John sky survey. However, on arrival at Mount John it was found that the lens already in the *Cook Telescope* was in no way inferior, differed negligibly in characteristics and would be more convenient to adjust and operate than the lens which was to be installed in its place. The 12.5 cm f/7 Ross lens of the *Cook Telescope* has therefore been used as the *Survey Astrograph* in obtaining all the negatives at Mount John.*

The *Cook Telescope Survey Astrograph* was fitted with a holder to accept the 30.5 by 30.5 cm survey plates and guiding was carried out with the 25 cm lens using an eye-piece in a compound slide. The *Survey Astrograph* has a nominal scale of 231 arc second per millimetre compared with the value of 232 quoted for the Mount Wilson Ross lens. The scales of plates 1 to 46 in the Mount John survey range from 231.30 to 231.53 (with estimated uncertainties of ±0.05).

3 PRODUCTION OF THE MOUNT JOHN SKY SURVEY PLATES

All the regions in the survey have been exposed from a single batch of 30.5 by 30.5 cm (12 by 12in) backed Eastman Kodak 103a-0 plates of 2.29 mm (0.090in) thickness. Exposures were made only on nights when the sky background was not significantly affected by scattered moonlight and the observing conditions were such that a plate of sufficiently high standard was likely to be obtained. Every effort was made to re-photograph those regions for which plates were found to be affected significantly by a deterioration in the conditions during the exposure time. Those plates which remain an essential part of the survey despite some minor defect and those for which the normal 90 minute exposure time was interrupted in some way or were not equally divided by the meridian transit time of the nominal plate centre are included in the list of plates for

*The *Cook Telescope* is not the only connection between Mount John University Observatory and the historic era of telescope and observatory construction associated with such names as Fecker, Cook, John A. Brashear and Reese W. Flower. Another instrument now at Mount John, but not yet operational, is the 45 cm *Flower Refractor* manufactured by Brashear, a telescope maker with a great range of well-known achievements during the period around the turn of the century. This refractor, whose objective was earlier used at Lowell Observatory, became the first instrument of the Flower Observatory of the University of Pennsylvania. Further details on its history and renovation are available in Wood & Size (1963), while King (1955) contains many interesting descriptions of the prolific work of Brashear (1925) who started the company that was later to become that of J.W. Fecker, now the J.W. Fecker Division of the American Optical Company, Pittsburgh.

which there are comments in section 7. For completeness the comments quoted in the *Lick Observatory Sky Atlas* concerning certain of the Lick survey plates are reproduced in that list.

Attempts were made initially to bend the plates in the manner carried out in the Lick survey to improve the definition near the corners. These attempts were abandoned following an intolerable loss of plates through breakages. The consequent loss of image quality near the corners does not appear to have been excessive.

The plates were developed within 24 hours of exposure for 8 minutes in Kodak D-19. Fixing, washing and drying were meticulously carried out to gain the maximum protection against deterioration of the emulsion with age.

For ease of application of overlay réseaux to the original plates a short fiducial mark has been applied to each edge of each plate to define the nominal centre and the orientation of the star field (1950 epoch). These marks have also served to include automatically the same facility on positive submasters reproduced on film, on contact prints and on the negative atlas sheets obtained by contact printing from the submasters.

The plates are maintained in permanent storage in the Department of Physics University of Canterbury.

4 REPRODUCTION OF THE POSITIVE FILM SUBMASTERS

The submaster transparencies reproduced from plates 1 to 46, and those to be obtained from plates 47 to 142, provide an invaluable record of the information on the original plates in the event of the loss of the latter. They also contain all the ancilliary information on the final atlas prints and have been prepared in such a way that the present Australis edition and any subsequent editions of the *Canterbury Sky Atlas* could be reproduced with a minimum of effort by contact printing. Appropriate orientation and positioning of the star field in the submaster as a whole and the existence of the fiducial marks minimizes the effects of any minor lack of centring of the telescope in obtaining the corresponding negative.

The positive star field submasters were produced on vacuum-secured commercial fine-grain continuous-tone film (Kodak CF7) by projection in the Helioprint Repromaster of Mannering and Associates, Photographers, Christchurch, with a 210 mm Repro-Claron process lens. Quartz-iodine lamps were used to give a diffuse uniformly illuminated background screen for transmission through the original negatives. Tests were carried out to show that the process lens aberrations, in particular distortion, were not significantly affecting the image quality and scale of the submasters. The scale of the original plates were reproduced in this step onto the submasters, without enlargement or reduction, to within about 1 part in 600.

The exposure times and occasionally the developing times (using Kodak HC110) were varied for density and contrast control, depending on the mean background density and range of densities across each of the original plates, to achieve maximum transfer of detail at the limiting magnitude and to obtain a greater degree of uniformity of submaster background density than was exhibited by the originals. The longest exposure time among plates 1 to 46 was double that of the shortest.

The submasters are maintained in permanent storage, separate from the original plates, in the University of Canterbury.

5 REPRODUCTION OF THE CANTERBURY SKY ATLAS (AUSTRALIS) PRINTS

In view of the known popularity of the *Lick Observatory Sky Atlas* and the desire to make copies of its southern extension available as widely as possible and at as low a cost as possible an initial edition (Australis, 1972) of 200 copies of only plates 1 to 46 was envisaged for the *Canterbury Sky Atlas*. The processing of such a large number of relatively large prints was clearly beyond the existing observatory and University of Canterbury photographic facilities and staffing. The standard of density and contrast control desired was also clearly exceptionally high and the nature of the overall task rather unusual for commercial printing to be considered. Nevertheless a decision was made to investigate this possibility.

The completion of the star fields on the final prints to the desired standard must be largely attributed to the cooperation and patience of the staff of Mannering and Associates, Photographers, Christchurch. The willingness of the principal, G.M. Mannering, to carry out extensive tests in collaboration with the writer and the Department of Physics, to make some adjustment to equipment and normal processing procedures and his competence in maintaining high quality throughout processing has made possible a comparatively large edition for an atlas of this type.

The negative atlas sheets were contact printed (vacuum-secured) during a twelve-month period up to March, 1972, in the Helioprint Repromaster of Mannering and Associates from a single batch of 30.5 by 38.0 cm (12 by 15in) double-weight glossy (unglazed) Ilfobrom paper (IB2.1K) from the positive submasters. Variations in exposure time were also necessary at this stage for density and contrast control for maximum transfer of faint detail and relatively uniform background density.

The prints were individually processed, each with fresh developer (Ilford Bromophen) on a Kodak K16 colour processor. Fixing and washing were meticulously carried out to minimize the possibility of deterioration in the prints with age.

6 GENERAL INFORMATION ON THE ATLAS PRINTS AND THEIR USE

6.1 PLATE NUMBERS A numbering scheme starting from 1 at the south pole and proceeding by increasing right ascension, starting at 0^h in each successive declination zone, was introduced for the plates of the Mount John survey (1 to 142) and extended in the same pattern to the north pole (plate 212). These numbers are recorded on each atlas print and displayed for further convenience, along with other items, in Tables I, II and III and in Figures 1, 2 and 3.

6.2 INDEX TO ADJACENT PRINTS Each print contains an index diagram of plate numbers to facilitate transfer to neighbouring regions of the survey.

6.3 PLATE COORDINATES AND DATES The nominal centre (1950 epoch) of each survey region is marked on the corresponding atlas print and defined by a fiducial mark along each edge of the field. The date the survey plate was exposed is also recorded on the corresponding prints. (These items of information for all the regions of both the Mount John and Lick surveys are also listed by plate number in Tables I, II and III.)

6.4 APPROXIMATE MAGNITUDE SCALE The survey plates and atlas prints are not primarily intended for use in making photometric (or astrometric) measurements. However, for convenience, an approximate scale from 2 to 11, based on stellar images from near the centre of one particular plate, has been reproduced on each print to permit an estimate to be made of the magnitude of an image. Variations in the observing conditions from one plate to another or in the production of the atlas sheets to obtain maximum transfer of faint detail may cause the magnitude scale to be quite inaccurate on some prints, particularly at the bright end of the scale. **The magnitude scale is approximate and should therefore be used only with great caution.** Vignetting near the edges and corners of the plates and off-axis aberrations could also affect magnitude estimates of stars if these are based only on the sizes of images separated by a large angular interval on the same plate.

6.5 PRINT SCALE The one-degree scale reproduced on each print is based on the plate scale of 231 arc second per millimetre of the original survey negatives. The actual print scales will differ from this value due to paper shrinkage in processing. This is generally slightly greater in the east-west direction than in the north-south but is not sufficiently systematic to permit representative values to be quoted. It is typically 1 part and at most 2 parts in about 300 leading to a print scale of about 232 or 233 arc second per millimetre.

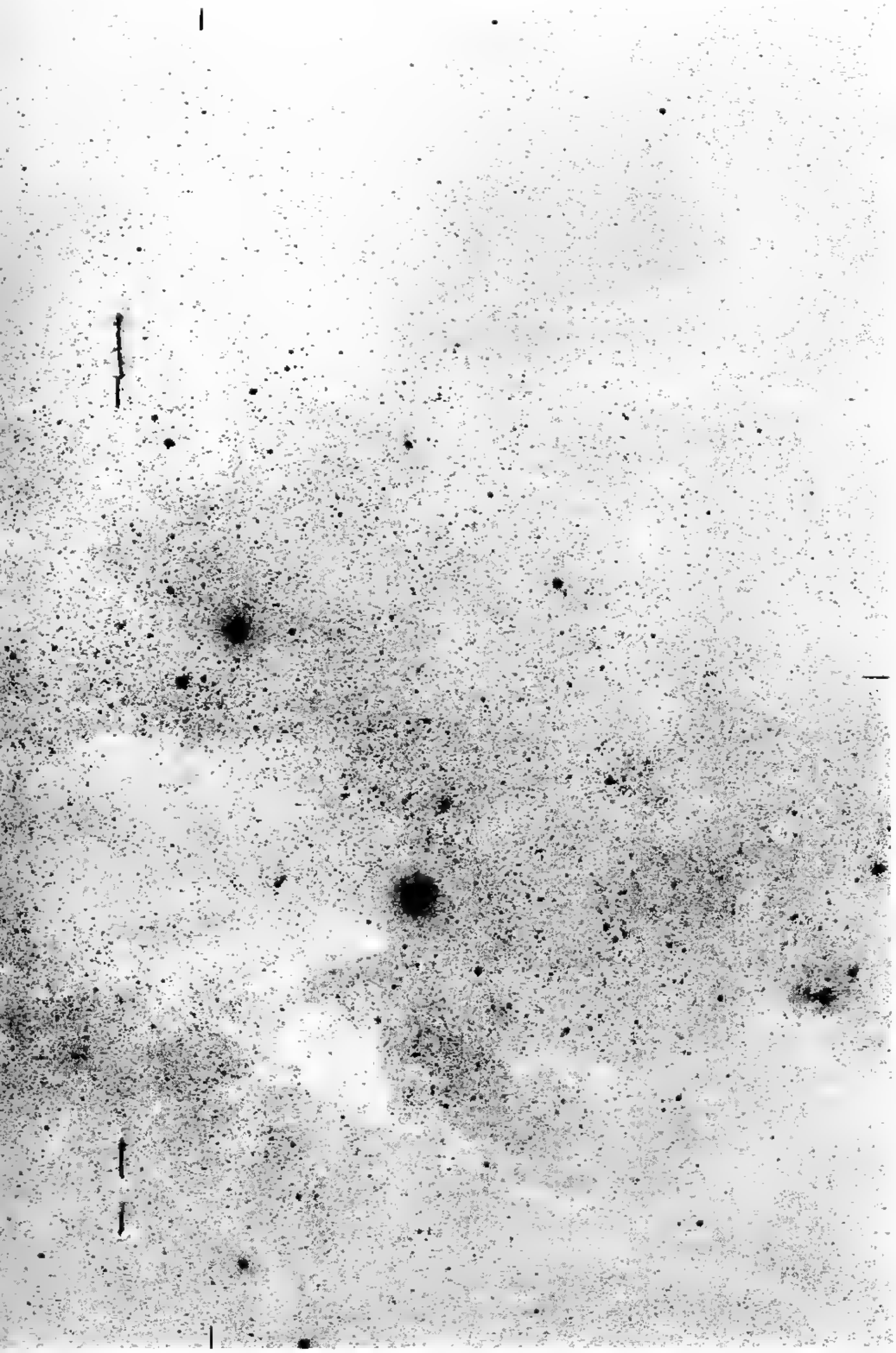
6.6 LIMITING MAGNITUDES The nominal limiting magnitude of the atlas may be taken as 16. The faintest stars recorded on each plate vary in brightness from one plate to the next, due primarily to the quality of the observing conditions, and range in magnitude from about 16 to about 17 at the centres of plates with some loss of faint detail towards the edges. One star fainter than B magnitude 17 has been easily identified in a photo-electric sequence on plate 20.

6.7 POSITION DETERMINATION USING OVERLAY RESEAUX The faintest stars have an image diameter of about 100 micron. With finely spaced equatorial overlay réseaux (computer-plotted) it was found to be quite easy to determine positions of images to ±0.5 arc minute. With careful registration of the overlay and confining measurements to a small region of a print the precision attainable was considerably higher. Overlay réseaux are being prepared for use with the original plates in the survey and it may be possible to reproduce these later on a stable base for distribution to users of the atlas in order to facilitate rapid position determination limited in precision only by the image quality and the fidelity of the reproductions with respect to the uniformity of the scale.

6.8 FIELD OF EACH PRINT The part of each star field reproduced on the prints measures 280 by 280 mm on the original plates covering a field of $18^\circ.0$ by $18^\circ.0$. The width of the area of overlap between adjacent prints of the atlas is therefore of the order of 3°.

Figure 4. THE MILKY WAY IN THE REGIO

A reproduction of Plate 20 of the *Canterbury Sky A*
350 arc second per millimetre.



Y IN THE REGION OF THE SOUTHERN CROSS

he *Canterbury Sky Atlas (Australis)* at a reduced scale of

7 COMMENTS ON CERTAIN PLATES

The hour angle quoted in the following entries is that of the middle of the exposure. The middle of the exposure for plates in the Mount John survey was always within 5^m of meridian transit and usually within 1^m.

PLATE	H.A. h	H.A. m	EXPOSURE	COMMENTS
1	2	8	–	Polar (0^h R.A. points upward on the prints)
6	23	3	–	–
13	–		91	–
16	0	3.5	85	Terminated by cloud
17	–		–	Affected by thin cirrus cloud
25	0	15	96	Two interruptions by cloud
29	–		91	Satellite trail
31	–		–	Meteor trail
32	–		–	Interrupted during satellite passage
35	–		93	–
46	23	1	–	–
51	0	11	–	–
52	0	6	–	Interrupted during satellite passage
52(Lick)	–		–	'Some haze during exposure' (Lick atlas)
78	22	50	–	–
80(Lick)	0	10	–	Extracted from Lick atlas
81(Lick)	–		–	'Some haze during exposure' (Lick atlas)
92	0	6.5		Interrupted to prevent dew on lens
95	–		–	Saturn prominent
96	Independent discovery by A.J. Thomas of Comet 1966c, Barbon. (Porter, 1967)			
102	23	15	–	–
102(Lick)	–		–	'Light haze during exposure (Lick atlas)
108	–		–	Interrupted by cloud
113(Lick)	–		80	'Clouds' (Lick atlas)
124	–		86	Terminated by cloud
126	22	30	–	–
127	–		–	Jupiter prominent
128	0	4	–	Delayed by wind
128(Lick)	–		–	'Light haze during exposure' (Lick atlas)
181(Lick)	–		–	'Centred 1^m west of tabulated position' (Lick atlas)
212(Lick)	19	57	–	Extracted from Lick atlas (0^h R.A. points downward on the prints)

8 PARTICIPANTS IN THE PROJECT AND ACKNOWLEDGEMENTS

SKY SURVEY The survey observing was initiated early in 1966 by C.D. Shane and was under his direction from California during 1966 and 1967. The programme was supported primarily from grant GP-4992 of the National Science Foundation (U.S.) to F.B. Wood and C.D. Shane, administered through the University of Pennsylvania. The direction at the observatory was carried out by the Astronomer-in-Charge, F.M. Bateson, until his retirement in 1969. During this period all but a few initial plates, taken by Shane in early 1966, were obtained by A.J. Thomas, Observer-technician at the observatory. Photographic assistance and experimentation with production of atlas prints was provided by E.R. Mangin of the Department of Physics. The writer has been responsible for the completion of the survey since 1970 supported by research assistant grants from the University of Canterbury. Observing, since its resumption in 1970, has principally been carried out by M. Clark, Observer-technician at the observatory.

ATLAS The production of the *Canterbury Sky Atlas (Australis)* in its present form has been directed by the writer since its inception in 1969, in consultation with C.D. Shane, supported primarily with a grant made from the National Aeronautical and Space Administration (U.S.) through the Astrophysics Section of the Manned Spacecraft Centre at Houston. This grant, to F.B. Wood and the writer, administered through the Universities of Florida and Canterbury, was supported by research assistant grants to the writer from the University of Canterbury. Assistance in Christchurch and at the observatory from A.J. Thomas, J. McLachlan, G.L. Dicker, B.G. Warren, K.A. Marsh, M. Clark, M.L. Hedwig and M.P. Ouin is gratefully acknowledged. The photographic reproduction of the submasters and atlas sheets has been carried out by Mannering and Associates, Photographers, Christchurch.

The authors also wish to acknowledge advice and assistance from numerous others, in particular Y. Kondo (N.A.S.A.), R.E. Watson (Lick Observatory) and W.E. Boyle (University Printer).

N.A.D.
Christchurch,
December 1972.

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TABLE I. SOUTHERN PLATE CO-ORDINATES AND DATES

PLATE	R.A. h	R.A. m	DECL. deg.	MOUNT JOHN SURVEY DATE (U.T.)			LICK SURVEY DATE (U.T.)			PLATE
1	Polar		−90	1967	May	13	—			1
2	0	0		67	Oct	26	—			2
3	2	24		67	Oct	8	—			3
4	4	48		66	Nov	9	—			4
5	7	12		67	Feb	7	—			5
6	9	36		68	Jan	5	—			6
7	12	00	−75	67	May	11	—			7
8	14	24		66	Mar	31	—			8
9	16	48		66	Apr	19	—			9
10	19	12		66	Jul	14	—			10
11	21	36		66	Jul	14	—			11
12	0	0		66	Sep	19	—			12
13	1	36		66	Oct	7	—			13
14	3	12		66	Oct	19	—			14
15	4	48		67	Dec	1	—			15
16	6	24		67	Dec	7	—			16
17	8	00		68	Jan	6	—			17
18	9	36		66	Apr	14	—			18
19	11	12	−60	66	Apr	18	—			19
20	12	48		66	Apr	21	—			20
21	14	24		66	Jul	13	—			21
22	16	00		66	Apr	27	—			22
23	17	36		66	Jul	15	—			23
24	19	12		66	Aug	11	—			24
25	20	48		67	Sep	3	—			25
26	22	24		66	Jul	24	—			26
27	0	0		67	Oct	25	—			27
28	1	12		67	Aug	5	—			28
29	2	24		66	Sep	14	—			29
30	3	36		66	Dec	6	—			30
31	4	48		67	Dec	2	—			31
32	6	00		66	Dec	7	—			32
33	7	12		67	Feb	5	—			33
34	8	24		67	Jan	15	—			34
35	9	36		66	Apr	13	—			35
36	10	48	−45	66	Apr	22	—			36
37	12	00		66	Mar	21	—			37
38	13	12		66	Apr	27	—			38
39	14	24		66	Jul	9	—			39
40	15	36		66	Apr	21	—			40
41	16	48		66	Jun	17	—			41
42	18	00		66	May	16	—			42
43	19	12		66	Aug	17	—			43
44	20	24		66	Aug	19	—			44
45	21	36		66	May	30	—			45
46	22	48		66	Aug	18	—			46
47	0	0		66	Aug	11	1953	Nov	4	47
48	1	0		66	Oct	16	54	Sep	2	48
49	2	0		67	Oct	25	53	Nov	4	49
50	3	0		66	Sep	21	54	Sep	29	50
51	4	0		67	Oct	8	53	Nov	4	51
52	5	0		67	Dec	29	54	Nov	21	52
53	6	0		67	Jan	9	53	Nov	3	53
54	7	0		67	Feb	11	53	Dec	14	54
55	8	0		67	Jan	9	55	Jan	28	55
56	9	0		67	Jan	16	53	Dec	14	56
57	10	0		66	Mar	19	55	Jan	28	57
58	11	0		66	Mar	20	55	Mar	17	58
59	12	0	−30	67	May	12	55	Jan	28	59
60	13	0		66	Mar	20	55	Mar	1	60
61	14	0		67	Jun	29	54	May	6	61
62	15	0		66	Jul	15	55	Mar	1	62
63	16	0		66	May	16	54	Apr	11	63
64	17	0		66	Jul	21	55	Jun	20	64
65	18	0		66	Apr	27	55	Jul	13	65
66	19	0		66	Jun	13	54	Jul	5	66
67	20	0		66	Jun	15	54	Sep	18	67
68	21	0		66	Jul	21	54	Jul	5	68
69	22	0		66	Aug	11	53	Nov	4	69
70	23	0		66	Jul	21	54	Sep	2	70

TABLE II. EQUATORIAL PLATE CO-ORDINATES AND DATES

PLATE	R.A. h	R.A. m	DECL. deg.	MOUNT JOHN SURVEY DATE (U.T.)			LICK SURVEY DATE (U.T.)			PLATE
71	0	0		1966	Aug	17	1953	Nov	25	71
72	1	0		66	Aug	18	54	Aug	30	72
73	2	0		71	Nov	7	53	Dec	31	73
74	3	0		66	Oct	16	54	Sep	30	74
75	4	0		67	Oct	10	53	Dec	31	75
76	5	0		66	Dec	31	54	Dec	17	76
77	6	0		67	Jan	13	53	Nov	4	77
78	7	0		72	Dec	2	54	Feb	24	78
79	8	0		67	Feb	9	55	Jan	24	79
80	9	0		67	Feb	7	54	Feb	1	80
81	10	0		66	Apr	15	55	Jan	24	81
82	11	0		66	Apr	24	54	Apr	23	82
83	12	0	−15	67	May	13	55	Feb	22	83
84	13	0		66	Apr	24	54	Apr	23	84
85	14	0		66	Jun	15	54	May	23	85
86	15	0		66	Apr	24	55	Mar	2	86
87	16	0		66	Jun	13	54	May	6	87
88	17	0		66	Aug	9	55	Jun	22	88
89	18	0		66	Aug	10	55	Jul	14	89
90	19	0		66	Jul	21	54	Jul	8	90
91	20	0		66	Jul	12	54	Aug	3	91
92	21	0		66	Jun	17	54	Aug	30	92
93	22	0		66	Aug	17	54	Aug	3	93
94	23	0		66	Aug	14	54	Aug	30	94
95	0	0		66	Oct	14	53	Oct	29	95
96	1	0		66	Aug	19	53	Oct	31	96
97	2	0		66	Aug	22	54	Sep	25	97
98	3	0		71	Nov	18	53	Oct	31	98
99	4	0		66	Oct	14	54	Sep	25	99
100	5	0		71	Nov	18	53	Dec	29	100
101	6	0		67	Jan	14	53	Dec	13	101
102	7	0		72	Dec	9	54	Feb	26	102
103	8	0		67	Jan	14	53	Dec	13	103
104	9	0		67	Feb	11	54	Feb	24	104
105	10	0		67	Feb	9	53	Dec	13	105
106	11	0	0	67	Feb	7	54	Apr	22	106
107	12	0		67	Apr	4	55	Mar	19	107
108	13	0		66	Jun	8	55	Mar	22	108
109	14	0		66	Jun	17	54	May	26	109
110	15	0		66	Jul	20	55	Mar	3	110
111	16	0		67	May	16	54	Jun	29	111
112	17	0		66	Jul	20	54	Jul	1	112
113	18	0		66	Jun	15	55	Jul	15	113
114	19	0		66	Jul	20	54	Aug	4	114
115	20	0		66	Aug	18	54	Aug	6	115
116	21	0		66	Jul	20	54	Aug	4	116
117	22	0		72	Jul	7	53	Oct	29	117
118	23	0		66	Jul	20	54	Aug	4	118
119	0	0		66	Jul	22	53	Oct	30	119
120	1	0		66	Jul	23	54	Sep	5	120
121	2	0		66	Oct	13	53	Dec	30	121
122	3	0		67	Oct	9	54	Sep	24	122
123	4	0		66	Oct	13	54	Oct	4	123
124	5	0		70	Dec	21	54	Oct	6	124
125	6	0		71	Nov	20	54	Feb	22	125
126	7	0		72	Dec	27	54	Oct	30	126
127	8	0		67	Mar	3	54	Feb	23	127
128	9	0		67	Feb	15	54	Feb	26	128
129	10	0		67	Apr	4	55	Mar	15	129
130	11	0	+15	67	Feb	11	55	Feb	23	130
131	12	0		66	May	19	55	Feb	20	131
132	13	0		66	Jun	9	55	Mar	18	132
133	14	0		66	Jun	16	54	May	27	133
134	15	0		67	May	11	55	Mar	22	134
135	16	0		66	Jun	16	55	Jun	19	135
136	17	0		66	Jun	18	55	Jun	23	136
137	18	0		66	Jul	22	55	Jul	16	137
138	19	0		67	May	16	54	Aug	23	138
139	20	0		66	Jul	22	54	Sep	19	139
140	21	0		66	Jul	23	54	Aug	23	140
141	22	0		66	Jul	22	54	Aug	6	141
142	23	0		66	Jul	23	53	Nov	8	142

TABLE III. NORTHERN PLATE CO-ORDINATES AND DATES

PLATE	R.A. h	R.A. m	DECL. deg.	MOUNT JOHN SURVEY DATE (U.T.)	LICK SURVEY DATE (U.T.)			PLATE
143	0	0	+30	–	1954	Aug	31	143
144	1	0		–	54	Sep	24	144
145	2	0		–	54	Aug	31	145
146	3	0		–	53	Dec	29	146
147	4	0		–	53	Dec	30	147
148	5	0		–	54	Nov	1	148
149	6	0		–	54	Feb	23	149
150	7	0		–	54	Nov	1	150
151	8	0		–	55	Jan	29	151
152	9	0		–	54	Feb	27	152
153	10	0		–	55	Feb	24	153
154	11	0		–	54	Feb	27	154
155	12	0		–	55	Feb	24	155
156	13	0		–	55	Mar	17	156
157	14	0		–	55	Mar	19	157
158	15	0		–	55	May	25	158
159	16	0		–	55	Jun	18	159
160	17	0		–	55	Jun	24	160
161	18	0		–	54	Aug	3	161
162	19	0		–	54	Aug	24	162
163	20	0		–	54	Aug	31	163
164	21	0		–	54	Aug	24	164
165	22	0		–	54	Aug	31	165
166	23	0		–	53	Oct	31	166
167	0	0	+45	–	53	Nov	28	167
168	1	12		–	54	Sep	6	168
169	2	24		–	54	Sep	26	169
170	3	36		–	53	Nov	3	170
171	4	48		–	54	Oct	23	171
172	6	00		–	53	Dec	30	172
173	7	12		–	54	Dec	21	173
174	8	24		–	55	Feb	19	174
175	9	36		–	55	Feb	20	175
176	10	48		–	55	Mar	16	176
177	12	00		–	55	Mar	20	177
178	13	12		–	55	May	11	178
179	14	24		–	55	May	23	179
180	15	36		–	55	Jun	16	180
181	16	48		–	54	Apr	12	181
182	18	00		–	55	Jul	17	182
183	19	12		–	54	Aug	22	183
184	20	24		–	54	Sep	3	184
185	21	36		–	54	Aug	8	185
186	22	48		–	54	Aug	7	186
187	0	0	+60	–	54	Aug	8	187
188	1	36		–	54	Sep	23	188
189	3	12		–	54	Oct	3	189
190	4	48		–	54	Oct	26	190
191	6	24		–	54	Oct	24	191
192	8	00		–	55	Feb	13	192
193	9	36		–	55	Feb	21	193
194	11	12		–	55	Mar	18	194
195	12	48		–	55	Mar	21	195
196	14	24		–	55	May	18	196
197	16	00		–	55	Jun	17	197
198	17	36		–	54	May	11	198
199	19	12		–	54	Aug	25	199
200	20	48		–	54	Aug	7	200
201	22	24		–	54	Aug	9	201
202	0	0	+75	–	54	Aug	6	202
203	2	24		–	54	Sep	27	203
204	4	48		–	54	Oct	30	204
205	7	12		–	54	Dec	20	205
206	9	36		–	55	Feb	22	206
207	12	00		–	55	Feb	21	207
208	14	24		–	55	May	16	208
209	16	48		–	54	Jul	2	209
210	19	12		–	54	Aug	5	210
211	21	36		–	54	Sep	4	211
212	Polar		+90	–	55	Aug	11	212

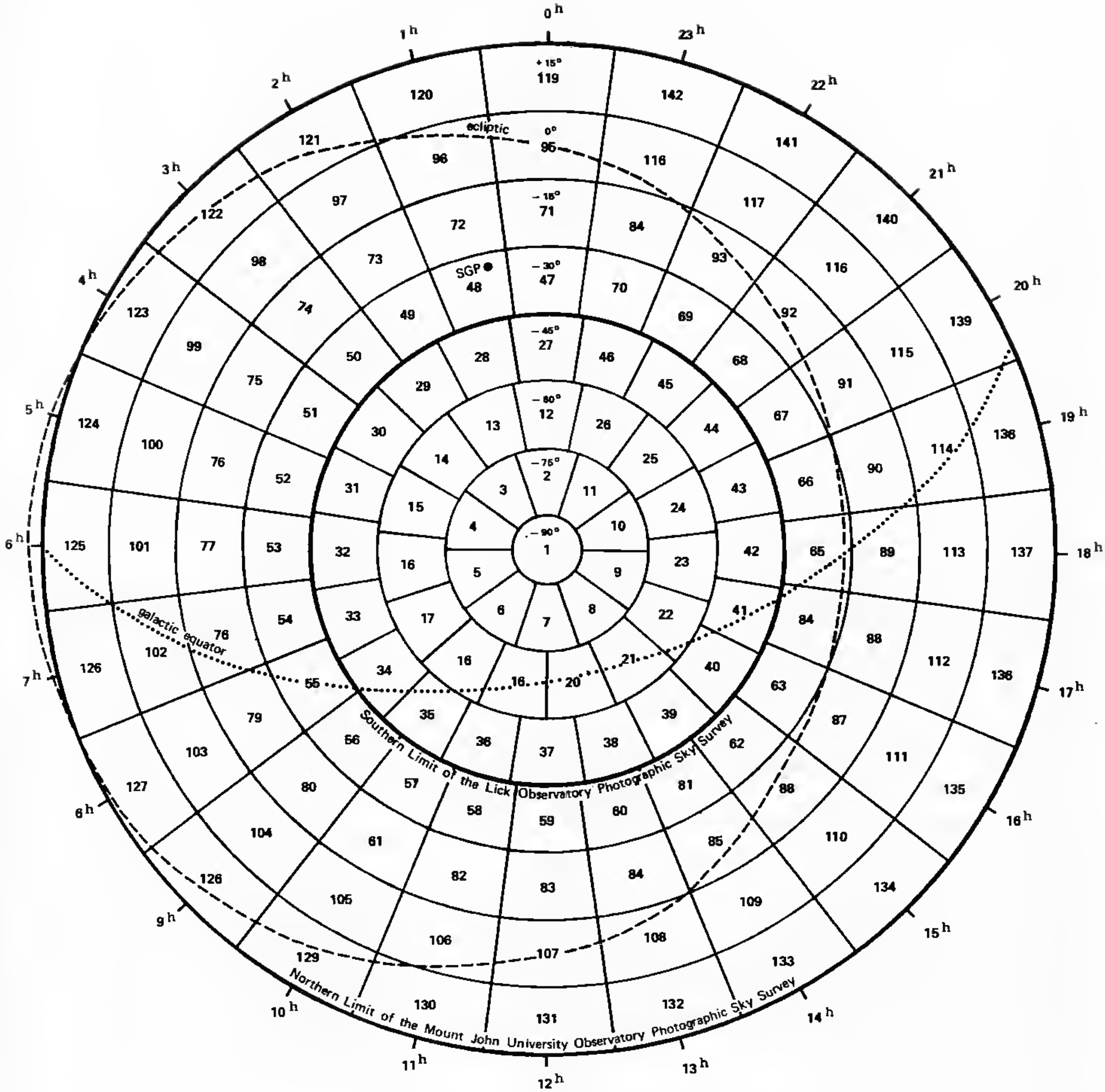

Figure 1. **SOUTHERN PLATE INDEX**

The plate numbers of the regions centred on declinations from -90° to +15° covered by the *Mount John University Observatory Photographic Sky Survey* and partly covered (-30° to +15°) by the *Lick Ohservatory Photographic Sky Survey*.

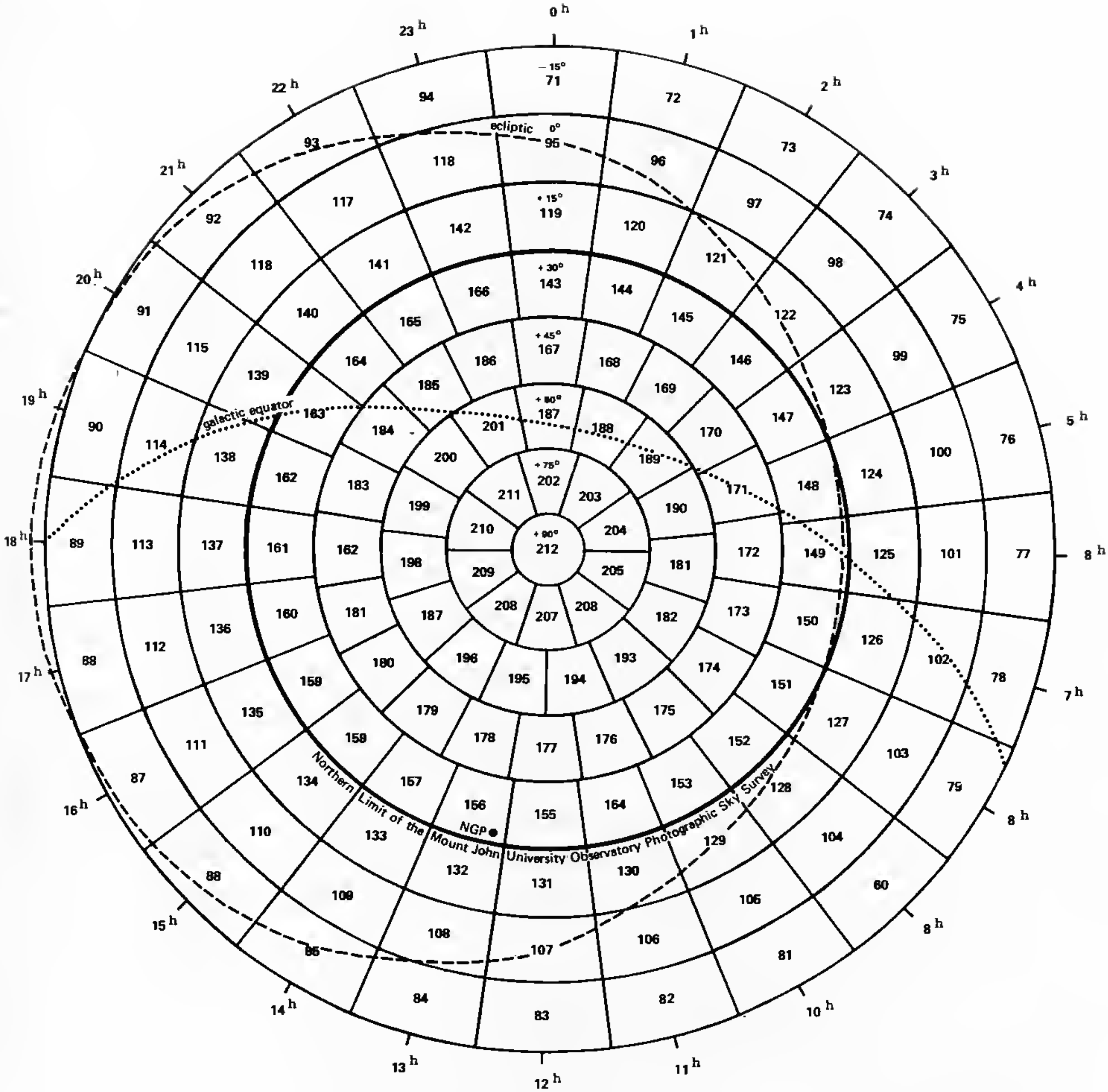

Figure 2. **NORTHERN PLATE INDEX**

The plate numbers of the regions centred on declinations +90° to -15° in the *Lick Observatory Photographic Sky Survey* and those centred on declinations +15° to -15° in the *Mount John University Observatory Photographic Sky Survey.*

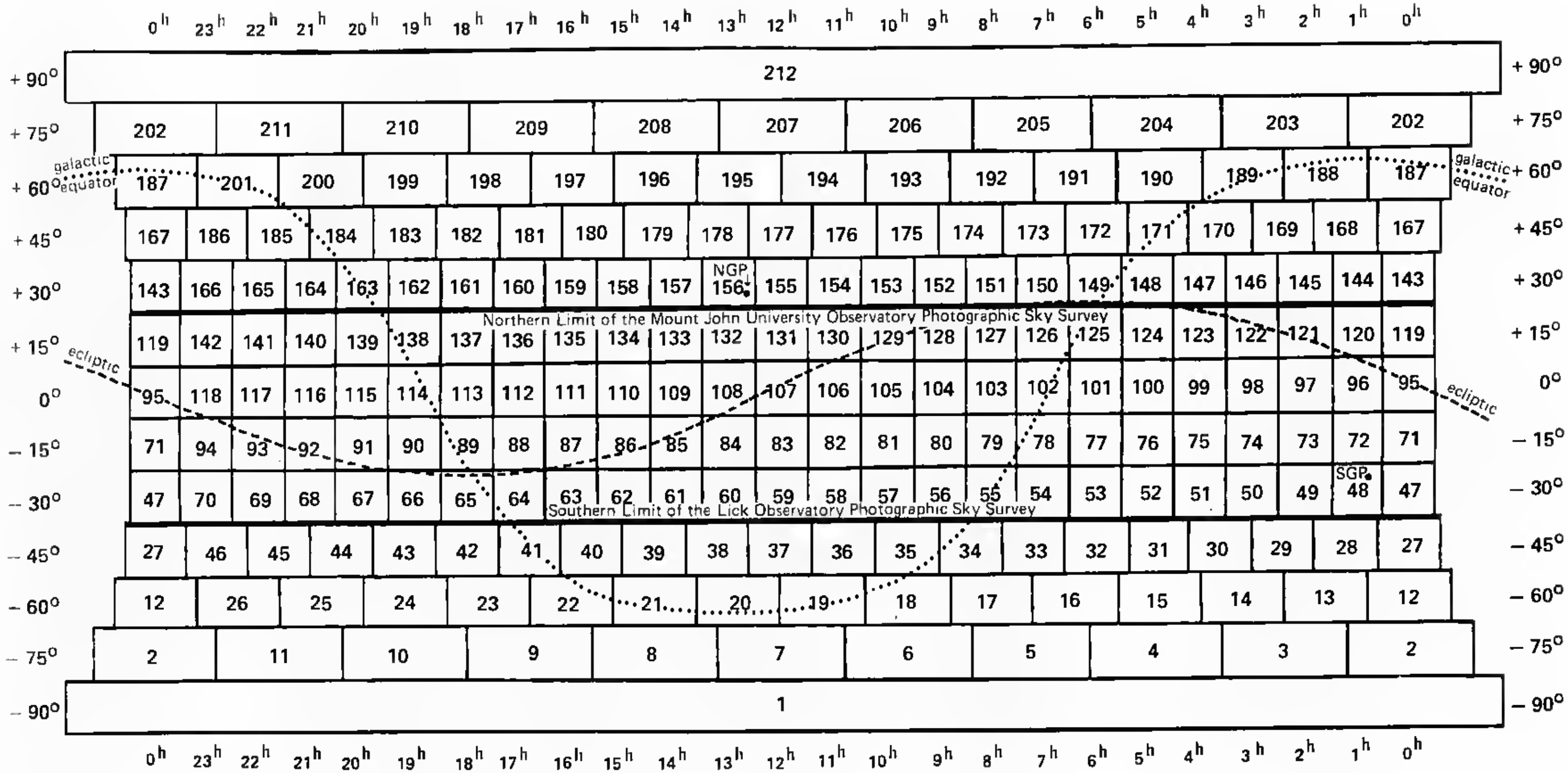

Figure 3. **ALL-SKY PLATE INDEX**

The plate numbers of the *Mount John University Observatory Photographic Sky Survey* extended to incorporate the northernmost regions covered only by the *Lick Observatory Photographic Sky Survey.*